



Designation: D6709 – 22

Standard Test Method for Evaluation of Automotive Engine Oils in the Sequence VIII Spark-Ignition Engine (CLR Oil Test Engine)¹

This standard is issued under the fixed designation D6709; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This test method is written for use by laboratories that utilize the portions of the test method that refer to ASTM Test Monitoring Center (TMC)² services (see [Annex A1](#)). Laboratories that choose not to use the TMC services may simply disregard these portions.

The TMC provides reference oils, and engineering and statistical services to laboratories that desire to produce test results that are statistically similar to those produced by laboratories previously calibrated by the TMC.

In general, the Test Purchaser decides if a calibrated test stand is to be used. An organization such as the American Chemistry Council require that a laboratory use the TMC services as part of their test registration process. In addition, the American Petroleum Institute requires that a laboratory utilize the TMC services in seeking qualification of oil against its specifications.

NOTE 1—The advantage of using the TMC services to calibrate test stands is that the test laboratory (and hence the Test Purchaser) has an assurance that the test stand was operating at the proper level of test severity. It should also be borne in mind that results obtained in a non calibrated test stand may not be the same as those obtained in a test stand participating in the ASTM TMC services process.

1. Scope*

1.1 This test method covers the evaluation of automotive engine oils (SAE grades 0W, 5W, 10W, 20, 30, 40, and 50, and multi-viscosity grades) intended for use in spark-ignition gasoline engines. The test procedure is conducted using a carbureted, spark-ignition Cooperative Lubrication Research (CLR) Oil Test Engine (also referred to as the Sequence VIII test engine in this test method) run on unleaded fuel. An oil is evaluated for its ability to protect the engine and the oil from deterioration under high-temperature and severe service conditions. The test method can also be used to evaluate the viscosity stability of multi-viscosity-graded oils. Companion test methods used to evaluate engine oil performance for specification requirements are discussed in the latest revision of Specification [D4485](#).

¹ This test method is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee [D02.B0.01](#) on Passenger Car Engine Oils.

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² Until the next revision of this test method, the ASTM Test Monitoring Center will update changes in this test method by means of Information Letters. Information Letters may be obtained from the ASTM Test Monitoring Center, 203 Armstrong Drive, Freeport, PA 16229, Attention: Director, www.astmtmc.org. This edition incorporates revisions in all Information Letters through No. 21–2.

1.2 Correlation of test results with those obtained in automotive service has not been established. Furthermore, the results obtained in this test are not necessarily indicative of results that will be obtained in a full-scale automotive spark-ignition or compression-ignition engine, or in an engine operated under conditions different from those of the test. The test can be used to compare one oil with another.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3.1 *Exceptions*—The values stated in inch-pounds for certain tube measurements, screw thread specifications, and sole source supply equipment are to be regarded as standard.

1.3.1.1 The bearing wear in the text is measured in grams and described as weight loss, a non-SI term.

1.4 This test method is arranged as follows:

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1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are provided throughout this test method.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:³

- D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- D235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
- D240 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter
- D323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
- D381 Test Method for Gum Content in Fuels by Jet Evaporation
- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D525 Test Method for Oxidation Stability of Gasoline (Induction Period Method)
- D1319 Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
- D2422 Classification of Industrial Fluid Lubricants by Viscosity System
- D2699 Test Method for Research Octane Number of Spark-Ignition Engine Fuel
- D2700 Test Method for Motor Octane Number of Spark-Ignition Engine Fuel
- D3231 Test Method for Phosphorus in Gasoline
- D3237 Test Method for Lead in Gasoline by Atomic Absorption Spectroscopy
- D3343 Test Method for Estimation of Hydrogen Content of Aviation Fuels
- D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

D4294 Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry

D4485 Specification for Performance of Active API Service Category Engine Oils

D4815 Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C₁ to C₄ Alcohols in Gasoline by Gas Chromatography

D7422 Test Method for Evaluation of Diesel Engine Oils in T-12 Exhaust Gas Recirculation Diesel Engine

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E191 Specification for Apparatus For Microdetermination of Carbon and Hydrogen in Organic and Organo-Metallic Compounds

2.2 SAE Standards:⁴

J183 Engine Oil Performance and Engine Service Classification (Other Than “Energy-Conserving”)

J304 Engine Oil Tests

3. Terminology

3.1 Definitions:

3.1.1 *air-fuel ratio, n*—in internal combustion engines, the mass ratio of air-to-fuel in the mixture being induced into the combustion chambers. **D4175**

3.1.2 *automotive, adj*—descriptive of equipment associated with self-propelled machinery, usually vehicles driven by internal combustion engines. **D4485**

3.1.3 *blind reference oil, n*—a reference oil, the identity of which is unknown by the test facility.

3.1.3.1 *Discussion*—This is a coded reference oil that is submitted by a source independent from the test facility. **D4175**

3.1.4 *blowby, n*—in internal combustion engines, that portion of the combustion products and unburned air/fuel mixture that leaks past piston rings into the engine crankcase during operation. **D4175**

3.1.5 *critical parts, n*—those components used in the test that are known to affect test severity.

3.1.6 *noncompounded engine oil, n*—a lubricating oil having a viscosity within the range of viscosities of oils normally used in engines, and that may contain anti-foam agents or pour depressants, or both, but not other additives. **D4175**

3.1.6.1 *Discussion*—In this test method noncompounded oil is also known as build-up oil.

3.1.7 *non-standard test, n*—a test that is not conducted in conformance with the requirements in the standard test method; such as running on an uncalibrated test stand, using different test equipment, applying different equipment assembly procedures, or using modified operating conditions. **D4175**

3.1.8 *test start, n*—introduction of test oil into the engine. **D4175**

3.1.9 *wear, n*—the loss of material from a surface, generally occurring between two surfaces in relative motion, and result-

ing from mechanical or chemical action or a combination of both. **D7422**

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *accessory case, n*—the mounting base containing the balancing mechanism, flywheel, and final driveshaft for the power section of the CLR engine.

3.2.2 *build-up oil, n*—see 3.1.6, noncompounded engine oil.

3.2.3 *calibrated power section/test stand combination, n*—one that has completed an operationally valid reference oil test within the previous six months, the results of which fall within industry severity and precision limits as published by the TMC.

3.2.4 *conditioning test run, n*—a full-length Sequence VIII test using a TMC-designated reference oil in a new or newly rebuilt power section to prepare the cast iron parts before conducting routine standard tests with the power section.

3.2.5 *emergency shutdown, n*—the procedure for turning off the engine’s ignition without using the prescribed engine cool-down period.

3.2.6 *full-length test, n*—a test of an engine oil conducted using a power section and a test stand that runs 4.5 h run-in, 2 h flush and 40 h at test conditions. (See 10.1.2.1, exception for 10 h stay in grade test).

3.2.7 *new power section, n*—an engine power section consisting of either a new crankcase or complete power section that has no previous oil test history.

3.2.8 *off-gas, n*—gas exiting the power section crankcase breather.

3.2.9 *off-test time, n*—any time that the engine is not operating at the prescribed test conditions.

3.2.10 *oil gallery side cover plate, n*—crankcase cover plate that contains the oil gallery and provision for mounting and driving the oil pump and ignition assembly.

3.2.11 *operationally valid test, n*—an engine oil test that has been conducted in accordance with the conditions listed in this test method.

3.2.12 *power section, n*—the combination of the crankcase assembly, the cylinder block assembly, and the cylinder head assembly, all of which are attached to the accessory case.

3.2.13 *reconditioned power section, n*—an engine power section which has been disassembled, cleaned, and reassembled according to the detailed procedures⁵ after completion of either a conditioning test run or a full-length CLR engine oil test.

3.2.14 *reference oil test, n*—a standard Sequence VIII engine oil test of a reference oil designated by the TMC, conducted to ensure that power section and test stand severity falls within industry limits.

3.2.15 *run-in and flush, n*—the initial 4.5 h operation of a new, rebuilt, or reconditioned power section at the beginning of either a conditioning test run or a full-length test.

⁴ Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096. Request SAE Handbook Vol 3. This standard is not available separately.

⁵ Refer to Instructions for Assembly and Disassembly of the CLR Oil Test Engine, available from Test Engineering, Inc., 12718 Cimarron Path, San Antonio, TX 78249.